

Comparative evaluation of fruit biometric parameters of local cherry cultivars and forms

Presented at the Conference 'A century of forest knowledge – education, innovations, challenges (CENFORKNOW 2025)', 7–9 May 2025, Sofia, Bulgaria

Thematic field: Agriculture in mountainous and semi-mountainous regions

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Received: 25 June 2025 / Accepted: 22 August 2025 / Available online: 27 August 2025



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Abstract

In 2023, during scientific expeditions in the regions of Shumen, Ruen, Kuklen, Osmar, Varna and Aytos, part of a project for preservation of local genetic resources, nine local cherry cultivars and forms were discovered. The aim afterwards was to make a pomological description and identify the cultivars, as well as determining biometric parameters and ripening dates. Specimens were mapped with GPS coordinates in the project's database, the ripening period of the fruits was determined, as well as their pomological characteristics. Biometric analyses of fruit and stones were performed and compared to the standard cultivars 'Van' and 'Bigarreau Burlat'. The earliest ripening fruits are of specimen SS-08 on 8 June, and the latest ripening are of SM-29 is on 26 June. Specimen SS-06 had the highest fruit weight 6.09 g from the discovered cherry forms, and SM-29 had the lowest fruit weight 1.31 g. The stone weight ranged from 0.15 g in SM-29 to 0.36 g in SS-06. The shortest stalk was measured for SS-09 at 22 mm and the longest for SS-08 at 62 mm.

Key words: biometric analyses, fruit, genetic resources, local forms, old cherry cultivars, stone.

Introduction

Genetic resources are valuable heritable material possessing the genetic information of given cultivars and their parent.

Their conservation and preservation are important as climate change and genetic erosion lead to their extinction (Thor-

mann and Engels 2015, Salgotra and Chauhan 2023). In different countries, local cultivars possess a variety of valuable agronomic and biological characteristics that represent a valuable genetic resource for breeding activities in the creation of new cultivars (Kirca and Aygün 2024, Perju et al. 2025).

The creation of new cultivars in the world is increasing annually and their introduction into our country is inevitable. However, their adaptability poses risks to the growing conditions in our country. In Bulgaria, there is a wide variety of native species and wild forms, which are a valuable source of genetic material possessing resistance to abiotic and biotic stress factors (Vasilev et al. 2019). For the effective use of local cultivars in the breeding programs, it is necessary to conduct complex studies aimed at identifying their positive biological and agronomic characteristics. This will support the precise selection and formation of appropriate parental combinations leading to the creation of new varieties with optimal economic qualities (Reim et al. 2023). By using them in breeding, as donors of genetic material, resistant cultivars are created (Zhivondov 2012). For this, a team of scientists from the Fruit Growing Institute – Plovdiv (FGI) focused on searching for old cultivars in different regions of the country, completed series of expeditions across the country though out extended period of time. In this way, representatives of many local cultivars and forms with valuable characteristics were found and mapped with GPS coordinates.

The aim of the present study was pomological description of the discovered cherry forms and identified cultivars, linking the biometric parameters and ripening dates to exact GPS coordinates of the discovered specimens.

Materials and Methods

During a survey in the area around Shumen city (43°15'58.7" N, 26°56'19.2" E) and city of Varna (43°13'09.7" N, 27°45'25.5" E), one cultivar and several

cherry forms were found (Table 1).

Also, in the area around town of Kuklen (42°01'33.5" N, 24°44'40.7" E) and village of Ruen (42°00'49.3" N, 24°48'22.2" E) the cultivars 'Ruenska belitsa' and one local cherry form were found. A GPS coordinate map has been compiled, and the fruit ripening dates were visually determined. Pomological descriptions were made. The biometric parameters of fruit height, thickness and width were measured using a digital calliper. Fruit and stone weight were determined by measuring 25 fruits using an electronic balance. The results were statistically processed using the method developed by David B. Duncan (Duncan 1955, Harter 1960). The software used was R version 3.1.3, in combination with RStudio version 0.98 and agricolae package version 1.2-2 (Mendiburu 2015).

Results and Discussion

Through the compilation of pomological descriptions of the cultivars and forms discovered, the research team aim at specimen identification, conservation and selection of valuable traits usable in future breeding work.

The located cherry cultivars and forms ripen in June, in the first ten days ripen the fruits of SS-08 locally referred to as 'Byala cheresha', SS-06 identified as 'Cherna osmarka' and SS-05 not yet identified. Maturing in the second ten days are SM-04 identified as 'Ruenska belitsa' and SS-09, SS-10 and SS-11 that not identified.

Last to ripen at the end of the month were the fruits of SM-29 grafted local form of bird cherry and SS-07 referred to as 'Starata cheresha' (Table 1). The fruit shape is oblate in SM-04, SM-29, SS-08 and SS-11. Reniform shaped were SS-06, SS-07, SS-09 and SS-10. Cordate shape

Table 1. GPS coordinates and ripening date of cherry forms and cultivars.

Sample No	Origin of the sample		Date of sampling	Ripening time at the originating region	Notes
	Coordinates	Locality			
SM-04	42°00'49.3" N 24°48'22.2" E	Ruen (Bogorod-ichno) village	17.06.2021	14 Jun	Identified as 'Ruenska belitsa'
SM-29	42°01'33.5" N 24°44'40.7" E	Kuklen Monastery 'St. St. Kozma and Damyan'	26.06.2021	26 Jun	Local form bird cherry grafted on <i>P. mahaleb</i>
SS-05	43°12'38.8" N 26°50'43.6" E	Han Krum village (road to Osmar)	09.06.2023	10 Jun	N/a
SS-06	43°13'01.7" N 26°50'22.5" E	Osmar village	09.06.2023	9 Jun	Identified as 'Cherna osmar-ka'
SS-07	43°12'07.0" N 26°57'14.1" E	Marash village	10.06.2023	24 Jun	Referred to as 'Starata cheresha'
SS-08	43°15'58.7" N 26°56'19.2" E	Shumen city	10.06.2023	8 Jun	Referred to as 'Byala cheresha'
SS-09	43°13'09.7" N 27°45'25.5" E	Varna city (suburbs)	11.06.2023	17 Jun	N/a
SS-10	42°41'14.9" N 27°08'46.4" E	Aytos city (highway to Karnobat)	11.06.2023	15 Jun	N/a
SS-11	42°41'28.1" N 27°09'47.1" E	Aytos city (highway to Karnobat)	11.06.2023	12 Jun	N/a

had only specimen SS-05. The different degrees of basic colouration of the fruit skin in the cultivars and forms observed varied from dark red and light red to yellow. SS-06, SS-10 and SS-11 have dark red colouring. Red colour was identified only in SS-07. Light red skin colouration was present in SM-29 and SS-09. Fruit ground (basic) colour for SM-04, SS-05 and SS-08 is yellow. Bicoloured cherries are SM-04 and SS-05 with light red as cover fruit colour (Table 2).

Fruit weight is a heritable trait determining fruit size and the first indicator attracting the consumer (Nesheva et. al. 2020, Sejfić et. al. 2023). The weight of the cultivars studied ranged from 1.31 g for SM-29 to 9.59 g for the standard 'Van', and the difference between the different

cultivars was statistically proven (Table 3). With similar values to 'Bigarreau Burlat' for the fruit weight was found for cherry SS-06 with an average mass of 6.09 g. Medium sized fruits with mass between 4–5 g were reported, such specimens are SS-11 and SS-10, SM-04, SS-07, SS-08 and SS-09. A smaller value was reported for SS-05 – 3.83 g. The greater the mass of the fruits the greater their dimensions for fruit height, width and thickness (Table 4).

The smallest average stone value was observed in the same forms having the smallest fruit mass SM-29 – 0.15 g and SS-05 – 0.19 g. An average mass between 0.25 g and 0.27 g have SM-04, SS-08, SS-09 and SS-11. The fruits of the

Table 2. Pomological characteristics of cherry fruits.

Sample No	Fruit shape	Fruit colour – basic/ground	Fruit colour – cover
SM-04	Oblate	Yellow	Light red
SM-29	Oblate	Light red	N/a
SS-05	Cordate	Yellow	Light red
SS-06	Reniform	Dark red	N/a
SS-07	Reniform	Red	N/a
SS-08	Oblate	Yellow	N/a
SS-09	Reniform	Light red	N/a
SS-10	Reniform	Dark red	N/a
SS-11	Oblate	Dark red	N/a

Table 3. Weight of fruit and stone length of stalk length.

Sample No	Fruit weight, g	Stone weight, g	F/S ratio, %	Stalk length, mm
SM-04	4.64 ef	0.27 c	5.82	40.21 c
SM-29	1.31 i	0.15 e	11.24	23.36 e
SS-05	3.83 h	0.19 d	4.90	38.70 cd
SS-06	6.09 c	0.36 a	5.98	38.42 cd
SS-07	4.92 e	0.33 b	6.73	37.47 cd
SS-08	4.31 fg	0.27 c	6.31	62.61 a
SS-09	4.08 gh	0.25 c	6.24	22.88 e
SS-10	5.85 cd	0.34 ab	5.82	47.09 b
SS-11	5.62 d	0.27 c	4.76	35.67 d
'Bigarreau Burlat'	6.98 b	0.33 b	4.67	24.63 e
'Van'	9.59 a	0.34 ab	3.56	22.23 e

Note: Different letters in the same column indicate a significant difference at $p = 0.05$.

two reference cultivars 'Bigarreau Burlat' and 'Van', SS-07 and SS-06 had an average weight between 0.33 g to 0.36 g. The obtained biometric dimensions of height, width, and stone thickness were within normal limits corresponding to the obtained mass (Table 5). One of the important indicators is the ratio of fruit flesh to stone. From the cultivars and shapes examined, we find that these are within the acceptable range. In a study Blazkova (1987) found that the ratio of stone to fruit fresh weight ranged from 3.7 to 8.4 %. The percentages obtained in our study fall within these limits. The

exception is SM-29 where the percentage obtained exceeds the upper limit of 11.24 %.

Comparing the stalk length of all nine cherry forms and cultivars found, we find that only SS-09 and SM-29 are close in size to those of the two standards. On average, the stem values are longer in the range of 35 mm to 40 mm. The longest stalk was measured in SS-08 'Byala cheresha' (White cherry) at 62.61 mm.

Figure 1 shows photographs of cherry cultivars and forms found. Variation in fruit colour, fruit size, and stalk length can be observed.

Table 4. Biometric characteristics of cherry fruits.

Sample No	Fruit height, mm	Fruit width, mm	Fruit thickness, mm
'Bigarreau Burlat'	22.52 b	23.27 b	19.61 b
SM-04	20.83 c	19.79 ef	17.19 f
SM-29	12.29 h	13.11 i	11.85 i
SS-05	16.77 g	18.16 h	15.56 h
SS-06	20.96 c	21.78 c	18.17 de
SS-07	19.41 d	20.08 e	17.85 e
SS-08	18.53 e	18.89 g	15.53 h
SS-09	17.55 f	19.29 fg	16.61 g
SS-10	19.00 de	21.80 c	19.02 c
SS-11	18.91 de	20.80 d	18.45 d
'Van'	24.24 a	26.92 a	22.04 a

Note: Different letters in the same column indicate a significant difference at $p = 0.05$.

Table 5. Biometric characteristics of cherry stone.

Sample No	Stone height, mm	Stone width, mm	Stone thickness, mm
'Bigarreau Burlat'	11.88 a	6.79 d	8.65 c
SM-04	10.90 c	5.88 g	7.92 d
SM-29	7.30 g	5.18 h	6.65 f
SS-05	8.66 f	6.34 e	7.61 e
SS-06	11.43 b	7.54 a	9.35 a
SS-07	11.07 bc	7.02 bc	8.99 b
SS-08	11.07 bc	6.09 f	8.41 c
SS-09	9.85 de	6.85 cd	7.93 d
SS-10	10.22 d	7.43 a	9.09 b
SS-11	10.24 d	6.92 bcd	8.64 c
'Van'	9.70 e	7.07 b	9.03 b

Note: Different letters in the same column indicate a significant difference at $p = 0.05$.

Conclusions

All cherry specimens from local forms and old cultivars discovered during this research have been mapped with exact GPS coordinates linked with pomological description for future exploitation and preservation. The search, study and preservation of such specimens is continuous

and a priority for the FGI. This will contribute to maintaining the Bulgarian heritage and culture.

Despite of their small fruit size, the old local cherry cultivars have diverse valuable qualities linked both to local traditions and biodiversity, vital to adaptation in ever changing climate and consumer preferences.



SS-05



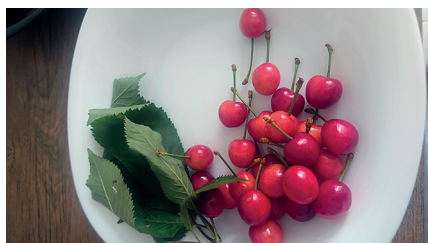
SS-06



SS-07



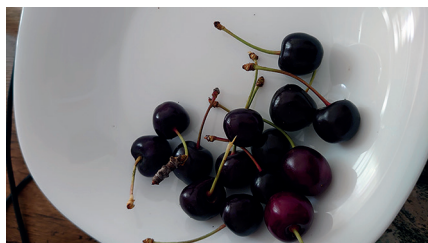
SS-08



SS-09



SS-10



SS-11



'Ruenska belitsa'

Local form bird cherry grafted on *P. mahaleb*

Fig. 1. Fruits of cherry forms and cultivars found.

Acknowledgment

This research is published with the funding support of project OL-18 'Creating, studying and preserving genetic resources from peaches, nectarines and cherries' funded by the Agricultural Academy, Sofia, Bulgaria.

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